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Research Article

Missed Cardiovascular Risk on Chest Computed Tomography: Opportunistic Detection and Reporting of Coronary Artery Calcification on Non-Contrast, Non-Gated Chest Computed Tomography

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ABSTRACT
Introduction: Coronary artery calcification (CAC) is an imaging marker of coronary atherosclerosis that can be identified on non-contrast, non-gated chest computed tomography (CT). However, it may not be documented when imaging is performed for non-cardiac indications.
Objective: To determine the prevalence and visual severity of CAC on non-contrast, non-gated chest CT and the proportion of detected cases documented in the original radiology reports.
Methods: This single-centre retrospective observational study included 300 adult patients who underwent non-contrast, non-gated chest CT at Peshawar Institute of Cardiology, Pakistan, between January 2023 and June 2026. CAC was assessed visually and classified as absent, mild, moderate, or severe. Findings were compared with the original radiology reports to determine reporting proportions. Demographic and clinical comparisons were descriptive.
Results: CAC was identified in 112 of 300 examinations (37.3%). Among these 112 examinations, 61 (54.5%) had mild, 35 (31.3%) moderate, and 16 (14.3%) severe CAC. CAC was documented in 61 (54.5%) of the original reports and was unreported in 51 (45.5%). The reporting proportion increased from 41.0% for mild CAC to 68.6% for moderate and 75.0% for severe CAC. CAC prevalence was higher among patients aged ≥55 years and those with hypertension, diabetes, or a current or former smoking history.
Conclusion: CAC was present in more than one-third of the included chest CT examinations, and almost half of detected cases were not documented in the original reports. Systematic visual assessment and severity-based reporting may improve communication of coronary atherosclerotic findings for clinical cardiovascular risk assessment.

Keywords: Coronary Artery Calcification, Non-Gated Chest CT, Opportunistic Screening, Cardiovascular Risk, Coronary Atherosclerosis, Radiology Reporting.

INTRODUCTION

Coronary artery disease is a leading cause of mortality and morbidity globally, and coronary artery calcification (CAC) is a well-known imaging biomarker of coronary atherosclerosis and cardiovascular risk. While electrocardiogram-gated cardiac computed tomography (CT) is the standard method for evaluation of CAC, chest computed tomography (CT) performed for other indications such as pulmonary, oncological, infectious, and other indications can also demonstrate coronary calcification. This allows for cardiovascular risk to be identified without an additional scan or radiation exposure. The current recommendations highlight the potential for opportunistic CAC detection on non-cardiac chest CT as a pragmatic strategy to enhance cardiovascular prevention and risk stratification for those who may benefit from additional risk assessment (1). Although clinically significant, CAC is not consistently recognized and reported in non-gated chest CT.

It is a potentially important missed opportunity, as coronary calcification can give clues to underlying atherosclerotic burden that may not be picked up during an examination performed for a non-cardiac reason. CAC detected on non-gated chest CT has been demonstrated to be associated with clinically important coronary disease, and reporting is

variable. The issue is not only whether CAC can be seen but also whether radiologists are able to detect and report this finding consistently to facilitate appropriate preventive care (2). Therefore, it is important to consider the cardiovascular assessment as an increasingly relevant part of thoracic imaging, especially in the context of opportunistic assessment. Several incidental cardiovascular abnormalities can be identified on chest CT, while CAC is especially useful as it is a marker of calcified coronary atherosclerotic burden. Evaluation of cardiovascular structures can be systematized and extend the value of already conducted examinations. Incidental cardiovascular findings have been reviewed and suggested that chest CT could be used in cardiovascular opportunistic screening and risk stratification, increasing the awareness of the radiologist and clinician (3).

This is further evidence that the finding is common enough to be considered routinely in interpretation, as it occurs in patients who are undergoing non-contrast, non-gated chest CT (4). The value of CAC for prognosis gives a good justification for its detection. While CT of the chest is not specifically designed to score coronary calcium, the presence of calcium in the chest may give valuable information about cardiovascular risk. Incidental CAC has been shown to be associated with higher rates of cardiovascular events and death than no detectable calcium. This correlation suggests that the use of CAC is not a trivial observation, but rather an imaging marker that could have implications for patient management (5). As a result, more and more evidence has emerged in favor of thoracic CT as a tool for opportunistic CAC assessment, such as methods that seek to enhance cardiovascular risk identification without the need for cardiac imaging. (6) CAC assessment may also be used in addition to traditional cardiovascular risk assessment.

Traditional risk assessment is based on age, hypertension, diabetes, smoking, and lipid abnormalities, while CAC provides imaging evidence of established coronary atherosclerotic burden. Therefore, the evaluation of CAC on non-gated chest CT can give further information for cardiac risk stratification, especially in patients with an underestimated cardiovascular risk (7). Importantly, the diagnosis of CAC can result in changes in preventive management. A systematic identification and communication of incidental CAC findings have been shown to drive statin use, as seen in the NOTIFY-1 project, where an imaging observation was translated to an actionable cardiovascular prevention strategy (8). The clinical relevance of CAC seen on chest CT is further supported by evidence of the association between the severity of the CAC and coronary disease. Even visual assessment of CAC on non-cardiac CT thorax has been shown to correlate with important coronary lesions and cardiovascular risk in retrospective studies, suggesting that even this information can be useful (9).

However, the effects of CAC can differ depending on patient factors. Age is especially significant because cardiovascular risk and coronary calcification prevalence increase with age. Therefore, in recent years age-dependent differences in the preventive value of incidental CAC have been investigated, which underscores the need to view the presence of coronary calcification in the context of demographic and clinical characteristics of the individual patient (10). The other significant advancement is the growing body of evidence that CAC from non-gated chest CT can offer clinically relevant prognostic information. While cardiac motion and technical factors may affect quantitative assessment, non-gated chest computed tomography (CT) can still be helpful for assessing coronary calcium and cardiovascular risk. This facilitates the use of existing exams to assess coronary calcification, instead of routinely ordering further cardiac imaging (11).

Lung cancer screening is one of the most significant settings since those receiving repeated low-dose chest CT scans may have significant cardiac risk. Consequently, a cardiovascular assessment during lung cancer screening could potentially be performed to identify cardiovascular conditions at the same time as lung cancer imaging (12). Consistent interpretation and reporting are essential for successful implementation. There are differences in acquisition parameters, reconstruction techniques, and image quality between non-gated chest CT examinations, and cardiac motion may impact the visualization of the coronary arteries. These factors may make it difficult to score quantitatively, but do not preclude the ability to recognize clinically significant calcification. Standardized reporting methods, appropriate clinical communication, and linkage to existing preventive pathways are important to ensure

that incidental CAC would result in appropriate clinical consideration (13).

Artificial intelligence could also help with this process, allowing for the automatic calculation of coronary calcium volume and density, which may further improve consistency and decrease the extra workload of systematic evaluation of large imaging datasets (14). Reporting is further supported by the association between incidental CAC and cardiovascular outcomes. Furthermore, studies have shown that when found in non-contrast, non-gated chest CT, CAC is linked to subsequent cardiovascular events, lending support to the idea that this is a marker for clinically relevant disease and not simply a radiological finding (15). In addition, thoracic CT can also identify other cardiovascular abnormalities such as those that might indicate a previous myocardial infarction, highlighting the importance of cardiovascular assessment in chest imaging (16). In recent years, automated analysis of images has also been shown to be possible for opportunistic cardiovascular risk assessment on chest computed tomography (CT) exams, even in lung cancer imaging patients (17). These findings collectively suggest that systematic detection and reporting of CAC is a feasible approach to improve communication of cardiovascular risk information.

Objective: To determine the prevalence and visual severity of CAC on non-contrast, non-gated chest CT, quantify its documentation in the original radiology reports, and describe its distribution across demographic and clinical groups.

MATERIALS AND METHODS

Study Design: This was a single-centre retrospective observational study with a cross-sectional assessment of CAC and reporting status.

Study Setting: The study was carried out at Peshawar Institute of Cardiology, Peshawar, Khyber Pakhtunkhwa (KPK) Pakistan.

Study Period: Eligible examinations were performed between January 2023 and June 2026.

Sample Size: The study included 300 examinations from 300 adult patients.

Sampling Technique: Eligible examinations within the study period were selected consecutively until the sample of 300 patients was reached.

Inclusion Criteria: Adults aged ≥18 years who underwent non-contrast, non-gated chest CT at Peshawar Institute of Cardiology during the study period for non-cardiac indications were eligible. Examinations were required to provide adequate visualization of the coronary arteries for CAC assessment.

Exclusion Criteria: Patients aged <18 years, dedicated ECG-gated cardiac CT examinations, technically inadequate or motion-degraded examinations that prevented adequate coronary assessment, and repeat examinations from the same patient were excluded. Previously known CAC or cardiovascular disease was not an exclusion criterion.

Image Review and Data Collection

Demographic characteristics and cardiovascular risk factors were obtained from available medical records. The left main, left anterior descending, left circumflex, and right coronary arteries were visually assessed for calcification. Each examination was classified as showing absent, mild, moderate, or severe CAC. The original radiology report was reviewed for documentation of CAC. Among examinations with CAC on study review, reporting status was classified as reported or unreported according to whether CAC was mentioned in the original report. Absence of a report mention was not considered proof that the finding had not been recognized during the original interpretation.

Statistical Analysis

Continuous data are presented as means and standard deviations, and categorical data as counts and percentages. CAC prevalence was calculated using all 300 examinations. Severity distributions used the 112 CAC-positive examinations, while reporting proportions used the number with CAC in each severity category. Group-specific prevalence was calculated using the corresponding group total. Crude prevalence ratios were calculated by dividing prevalence in patients with a risk factor by prevalence in those without it. Comparisons are descriptive; no adjusted predictor model or inferential significance is presented.

RESULTS

A total of 300 non-contrast, non-gated chest CT examinations were analysed. The mean patient age was 56.8 ± 13.7 years; 174 patients (58.0%) were male and 178 (59.3%) were aged ≥55 years. CAC was present in 112 examinations (37.3%) and absent in 188 (62.7%). Patients with CAC were older on average (64.1 ± 10.8 versus 52.4 ± 13.8 years) and more frequently male (68.8% versus 51.6%). Hypertension, diabetes

mellitus, dyslipidemia, current or former smoking, and prior cardiovascular disease were more frequent in the CAC-positive group (Table 1).

Table 1. Demographic and clinical characteristics of the study population, stratified by coronary artery calcification (CAC) status

Characteristic	Total (n = 300)	CAC present (n = 112)	CAC absent (n = 188)
Age, mean ± SD (years)	56.8 ± 13.7	64.1 ± 10.8	52.4 ± 13.8
Age ≥55 years	178 (59.3%)	91 (81.3%)	87 (46.3%)
Male sex	174 (58.0%)	77 (68.8%)	97 (51.6%)
Hypertension	103 (34.3%)	58 (51.8%)	45 (23.9%)
Diabetes mellitus	69 (23.0%)	39 (34.8%)	30 (16.0%)
Dyslipidemia	61 (20.3%)	35 (31.3%)	26 (13.8%)
Current/former smoking	96 (32.0%)	51 (45.5%)	45 (23.9%)
Previous cardiovascular disease	28 (9.3%)	19 (17.0%)	9 (4.8%)

Note. Values are n (%) unless otherwise stated. Percentages use the total for the respective column. SD, standard deviation; CAC, coronary artery calcification.

CAC prevalence was 17.2% (21/122) among patients aged <55 years and 51.1% (91/178) among those aged ≥55 years (Figure 1). It was 44.3% (77/174) among male patients and 27.8% (35/126) among female patients. These comparisons describe unadjusted differences between groups.

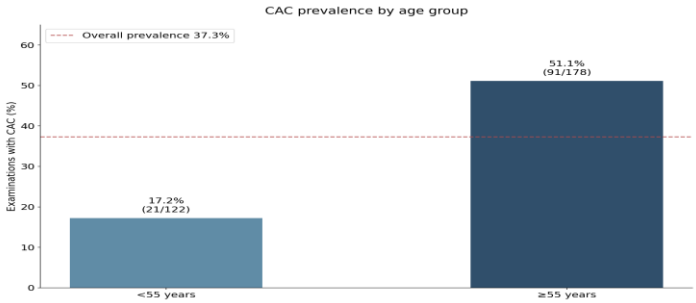


Figure 1. Prevalence of CAC by age group, calculated from the counts in Table 1. Labels show the number with CAC divided by the number in each age group; the dashed line indicates overall prevalence (37.3%).

Of the 112 examinations with CAC, 61 (54.5%) had CAC documented in the original report and 51 (45.5%) did not (Table 2). Reporting proportions increased with visual severity: 41.0% (25/61) for mild, 68.6% (24/35) for moderate, and 75.0% (12/16) for severe CAC. Among the 61 reported cases, 25 (41.0%) were mild, 24 (39.3%) moderate, and 12 (19.7%) severe. Mild CAC accounted for 36 of the 51 unreported cases (70.6%).

Table 2. Severity of coronary artery calcification and reporting status in the original radiology reports

CAC category	Detected, n (%)	Reported, n (%)	Not reported, n (%)
Absent	188 (62.7%)	—	—
Mild	61 (20.3%)	25 (41.0%)	36 (59.0%)
Moderate	35 (11.7%)	24 (68.6%)	11 (31.4%)
Severe	16 (5.3%)	12 (75.0%)	4 (25.0%)
Total CAC present	112 (37.3%)	61 (54.5%)	51 (45.5%)

Note. Detected percentages use all 300 examinations as the denominator. Reported and unreported percentages use the detected count within each row. A dash indicates that reporting of positive CAC is not applicable. Percentages may not sum exactly because of rounding.

CAC prevalence was 56.3% (58/103) in patients with hypertension versus 27.4% (54/197) in those without hypertension; 56.5%

(39/69) in patients with diabetes versus 31.6% (73/231) in those without diabetes; and 53.1% (51/96) in current or former smokers versus 29.9% (61/204) in patients without a smoking history (Figure 2). The corresponding crude prevalence ratios were 2.05, 1.79, and 1.78. These descriptive ratios were not adjusted for age or other potential confounders.

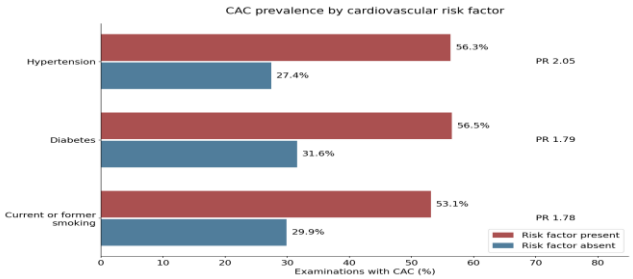


Figure 2. CAC prevalence according to hypertension, diabetes, and current or former smoking history. Crude prevalence ratios compare patients with each factor against those without it; they are unadjusted descriptive estimates.

Among examinations with CAC, 54.5% had mild, 31.3% moderate, and 14.3% severe calcification (Figure 3A). Moderate or severe CAC accounted for 51 of 112 examinations (45.5%). The proportion unreported was highest for mild CAC (59.0%) and lowest for severe CAC (25.0%) (Figure 3B). Overall, nearly half of examinations with CAC lacked documentation of the finding in the original report.

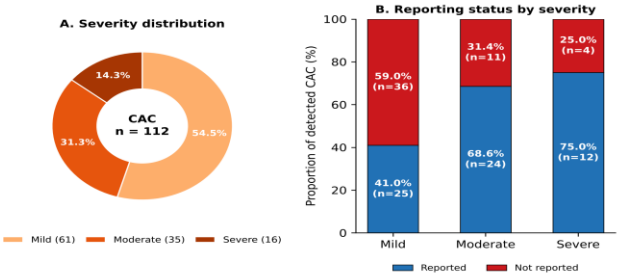


Figure 3. (A) Distribution of CAC severity among the 112 examinations with detected calcification. (B) Proportion of reported and unreported CAC within each severity category

DISCUSSION

CAC was present in 37.3% of the included non-contrast, non-gated chest CT examinations, and 45.5% of detected cases were not documented in the original reports. These findings identify a reporting gap in a selected hospital population. Reviewing existing chest CT images for CAC requires no additional scan or radiation exposure and can provide information relevant to cardiovascular assessment (1). However, detection on retrospective review and documentation in the original report are distinct outcomes; the present study assessed both, without establishing whether unreported CAC had been recognized by the original reader (2).

Chest CT can reveal incidental cardiovascular abnormalities, including coronary calcification (3,4). In this study, CAC prevalence was higher in patients aged ≥55 years than in younger patients. This descriptive difference is consistent with the accumulation of coronary atherosclerotic burden with age. Previous studies have linked incidental CAC to subsequent cardiovascular events and mortality (5), supporting interest in opportunistic assessment on thoracic CT (6). The present study did not measure subsequent cardiovascular events.

CAC was more frequent in patients with hypertension, diabetes, dyslipidemia, current or former smoking, and prior cardiovascular disease. These patterns are consistent with the role of traditional cardiovascular risk factors in coronary atherosclerosis and with published work on CAC assessment for risk stratification (7). However, the present comparisons were unadjusted and do not establish independent predictors. CAC was documented in 54.5% of positive examinations and unreported in 45.5%; this reporting gap

may limit the communication of relevant findings to treating clinicians.

The NOTIFY-1 project demonstrated increased statin prescribing following systematic notification of incidental CAC, supporting the value of communicating these findings (8). It does not establish that the reporting intervention proposed here would improve clinical outcomes in this population. Mild CAC was the most frequent severity category and had the largest proportion of unreported findings. Greater visual conspicuity may partly explain higher reporting proportions for moderate and severe CAC, although reasons for non-reporting were not assessed. Published associations between visual CAC severity and coronary disease further support documenting both less extensive and more extensive calcification (9).

CAC findings should be interpreted alongside age, symptoms, risk factors, prior cardiovascular disease, and existing treatment. Age-related differences in the potential preventive value of incidental CAC have been explored elsewhere (10), but the higher prevalence observed in older patients here does not justify restricting assessment to older age groups. Evidence comparing non-gated and gated CT supports the clinical relevance of CAC detected on existing scans (11); nevertheless, the visual categories used in this study should not be interpreted as equivalent to quantitative Agatston scores. Lung cancer screening provides another setting in which non-gated CT may reveal cardiovascular findings (12).

Consistent visual assessment and severity-based reporting offer a practical approach to documenting CAC. Acquisition parameters, reconstruction methods, and cardiac motion can affect visibility and quantitative measurement, making integration with clinical pathways important (13). Automated approaches may assist assessment in other settings (14), but no automated analysis is reported in this study. The association of incidental CAC with cardiovascular outcomes in previous research provides context for reporting these findings (15), rather than evidence of an outcome benefit demonstrated by the present data.

Thoracic CT may also reveal abnormalities suggesting prior myocardial infarction (16), and automated cardiovascular assessment is an evolving research area (17). The present findings specifically concern visual CAC detection and its documentation. Because patients with prior cardiovascular disease or known CAC were eligible, detected CAC cannot uniformly be described as previously unrecognized disease or a new primary-prevention opportunity. Standardized reporting may support appropriate clinical review, but changes in treatment, downstream testing, and patient outcomes were not evaluated.

Limitations

This retrospective single-centre study included a selected sample of 300 patients, limiting generalizability beyond similar clinical populations. Validation of visual grading against quantitative calcium scoring is not reported, and reader reproducibility is not reported. Descriptive group comparisons do not account for confounding, particularly by age. Inclusion of patients with prior cardiovascular disease or known CAC limits interpretation as newly detected disease. Lack of documentation does not establish failure of recognition. The study did not evaluate changes in treatment or subsequent cardiovascular outcomes.

CONCLUSION

CAC was identified in 112 of 300 non-contrast, non-gated chest CT examinations (37.3%), and 51 of the 112 positive examinations (45.5%) lacked documentation of CAC in the original report. CAC prevalence was higher in older patients and in several cardiovascular risk-factor groups, while mild CAC had the lowest reporting proportion. Systematic visual assessment and severity-based reporting may improve communication of coronary atherosclerotic findings for clinical risk assessment. The impact on management and cardiovascular outcomes requires further evaluation.

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